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Time-Use and Subjective Well-Being: Is Diversity Really the Spice of Life?

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ABSTRACT

Time-Use and Subjective Well-Being: Is Diversity Really the Spice of Life?*

Using the American and the French time-use surveys, we examine whether people have a preference for a more diversified mix of activities, in the sense that they experience greater well-being when their time schedule contains many different activities rather than is concentrated on a very small number. This could be due to decreasing marginal utility, as is assumed for goods consumption, if each episode of time is conceived as yielding a certain level of utility per se. With returns to specialization, people would then face a trade-off between efficiency and diversity in choosing how to allocate time. We examine these issues and investigate potential gender differences, considering both instantaneous feelings and life satisfaction.

JEL Classification: I31, J22

Keywords: time allocation, time-use diversity, subjective well-being, life satisfaction, momentary utility, gender

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1 Introduction

Although how to use one's time is certainly the most important decision a person has to make all along their life time, applied economic research has mostly reflected on a limited number of related issues, namely the global quantity of time people devote to labor supply versus leisure, education as an investment in human capital, and the division of tasks within the household. Beyond these specific topics, where time is considered as a pure input, the concrete mix of activities and their temporal arrangement has attracted less attention. In this paper, we are interested in the direct utility derived from the way people use their time, as opposed to the indirect utility allowed by this choice in terms of consumption. Hence, we are not considering the value of time as an input into the production of a commodity, as in Becker (1965), but rather as a consumption good that produces "experienced utility" (Kahneman et al., 1997) in itself. In consumer theory, convexity of preferences is generally assumed, implying that consumers have a taste for diversity. Is this assumption also relevant when it comes to the choice of how to allocate one's time over competing activities? If each episode of time is conceived as yielding a certain level of utility *per se*, people may have a preference for diversity in their mix of activities. They would thus reach a higher level of well-being or "experienced utility" by following a more diversified daily schedule rather than by concentrating their time on a very small number of activities.¹

Under this hypothesis, we would expect people's schedule to be fragmented into many different activities over the day, week or month span, in the way Karl Marx advocated for a (communist) society where it would be possible "to hunt in the morning, fish in the afternoon, rear cattle in the evening, criticise after dinner [...] without ever becoming hunter, fisherman, herdsman or critic".² However, in practice this type of time arrangement remains rare due to the countervailing force of increasing returns to specialized human capital, whereby a person becomes more efficient as she accumulates experience in a given task or type of activity over time. Increasing returns constitute a powerful driver of concentration of one's time and effort on a few activities (not to mention the potential short-run costs of adjusting between one activity and another). Does this create a trade-off between the efficiency of specialization and the taste for diversity, as concerns time allocation?

To enquire, we explore the empirical relationship between the structure of time-use and subjective well-being, using two time-use surveys that contain measures of self-declared life satisfaction and episode-based affect. We test two main hypotheses:

- H1. The association between measures of time-use diversity and life satisfaction is positive, potentially concave.
- H2. The returns to scale, in terms of subjective well-being, on the time spent on an activity are increasing. Hence, the relationship is convex. This would indicate positive returns to specialization.

An additional motivation for this study comes from the well-known gender differences, both in time-use and life satisfaction. On the one hand, it is common knowledge that women's and men's time-use differ, notably in the greater share of paid-work in men's time (Blau and Kahn, 2017) and the greater variety of women's activities (Gronau and Hamermesh, 2008). On the other hand, a large number of studies, mobilizing many different sources, show that women generally report a higher level of life satisfaction than men, especially in developed countries (Blanchflower and Oswald, 2004; Graham and Chattopadhyay, 2013; Helliwell et al., 2015; Becchetti and Conzo, 2022) although a recent paper qualifies this observation (Blanchflower and Bryson, 2022). Admittedly, women's higher satisfaction may be due to lower expectations (Plagnol and Easterlin, 2008; Stevenson and Wolfers, 2009). However, it could also be due to the specific pattern of their schedule - an hypothesis that we explore in this paper.

If it turns out that a substantial part of women's life satisfaction can be attributed to the diversity of their time-use, then why do men's schedule tend to focus on paid-work at the expense of diversity? Does this gender gap in time-use reflect different preferences, whereby men do not value diversity of activities as much as women do, or is it the expression of a traditional social norm, along the lines of the so-called "male breadwinner" norm, in which men are judged solely on the basis of professional and financial success, as opposed to women who enjoy a wider range of socially accepted combinations of family care and work commitment?³

We thus test three additional hypotheses:

- H3. Women's mix of activities is more diversified than that of men.
- H4. Women's greater variety of activities accounts for the observed gender gap in life satisfaction.
- H5. A greater variety of activities is equally associated with higher subjective well-being for men and women. (This would mean that gender difference in activity-diversity reflects different constraints weighing on women and men, rather than different preferences).

We test the aforementioned hypotheses using the American (ATUS) and the French (FTUS) time-use surveys, where people report the duration and succession of activities they have undertaken in a given day, together with a general evaluation of their life satisfaction on a Cantril scale. Each of these surveys presents distinct advantages. The ATUS offers a large sample size, where each individual is interviewed once, while that the FTUS sample is much smaller but documents two day-diaries for each individual, one during the week and one on the weekend. Both surveys also collect measures of momentary utility—the emotions felt by respondents during the time episodes of the day.

In both countries we find evidence that higher diversity in a person's activity portfolio is associated with higher life satisfaction (validating hypothesis H1). Furthermore, we find no evidence for increasing returns to the duration of activities in terms of "momentary utility" (hypothesis H2); rather we more often observe a concave relationship. We also document a significant gender gap in both countries, where women's life satisfaction is higher than men's (*ceteris paribus*) and the activity-mix of women is much more diversified than that of men (H3). In both the ATUS and the FTUS samples, women's greater index of activity-variety accounts for a non-negligible share of their higher satisfaction (H4), but the association between activity-diversity and life satisfaction is not specific to women, although, in the French sample, the association is stronger for women than for men (H5). In sum, the general picture is that activity-diversity contributes to life satisfaction; there are no increasing returns to specialization

in terms of subjective well-being; women's daily schedule is more diversified than men's; and this is associated with additional life satisfaction. However, men also enjoy time-use diversity, so that their lower degree of time-use diversity cannot be entirely attributed to different preferences.

To our knowledge, the only existing study that touches upon the question of variety in time-use is Gronau and Hamermesh (2008), who used Australian, Israeli and German time-use data, and observed that more educated people engage into a greater number of activities, which they attribute to the higher efficiency of their time both in the labor market and in household production. They also note the greater variety of women's daily schedules, as compared to men's. We complete this study by looking at how these patterns are associated with subjective well-being. We also extend the exploration of time-use structure by using an indicator of diversity, rather than a simple measure of variety, i.e by taking into account not only the number of different activities in a person's daily schedule, but also the degree of concentration of their distribution over time.

A large literature based on time-use data has explored the division of tasks within the household, especially the gendered specialization of spouses into paid-work versus housework (Hamermesh and Lee, 2007; Bianchi and Milkie, 2010; Gimenez-Nadal and Molina, 2020). Several studies have documented the upward trend in time spent on parenting, in particular by educated parents (Ramey and Ramey, 2009; Dotti Sani and Treas, 2016). A few papers have devoted attention to the impact of shocks, such as changes in the legal work time, economic fluctuations (Aguiar et al., 2013), child birth (Buddelmeyer et al., 2018), or widowhood (Adena et al., 2023). Others have explored people's preferences over different activities. Biddle and Hamermesh (1990) show that sleep and television-watching are uniformly inferior (and time-consuming) goods, especially TV-watching. Hamermesh (2019) showed that spending time with others increases life satisfaction (especially friends and spouse), and Adena et al. (2023) that, conversely, spending time alone is the reason for the greater unhappiness of widows. Finally, Hamermesh and Biddle (2018) extend the Beckerian commodity production model to study the allocation of time of different segments of the French and American population.

On the other hand, among the abundant literature on subjective well-being, that has been blooming for the last twenty years, not many papers have focused on time-use related issues. A famous paper by Stutzer and Frey (2008) has illustrated the negative impact of long commuting on life satisfaction. The aforementioned papers by Hamermesh (2019) and Adena et al. (2023) stress the importance of social time. Another stream of research has investigated the subjective quality of the experience associated with the different episodes composing people's diary, a.k.a. "momentary utility" (Stone et al., 1999; Robinson and Godbey, 1997; Stratton, 2012; Kahneman et al., 2004; Krueger et al., 2009b,a; Knabe et al., 2010).

This paper thus hopes to contribute a new stylized fact both to the literature dedicated to time-use and to the happiness literature. To do so, it proposes a characterization of activity-diversity, applying the Shannon-Wiener indicator to time-use data for the first time.

The paper continues as follows: section 2 discusses the measurement of activity-diversity and of subjective well-being. Section 3 presents the estimation strategy; Section 4 the data; Section 5 the results; and Section 6 concludes.

2 Main Metrics: Activity-Diversity and Subjective Well-Being

2.1 How to Measure Time-Use Diversity?

Measuring the diversity of time-use raises several challenges. Gronau and Hamermesh (2008) measure time-use variety as the number of *non-work* activities a person engages with throughout a day. However, variety is only one element of diversity, whose full concept also includes balance, i.e. the share of each activity, and disparity, i.e. the nature and degree to which the activity categories themselves are different from each other (Stirling, 1998). Measurement of time-use diversity may also differ according to the time span over which it is measured. In what follows we discuss these characteristics.

Balance. In order to take into account both variety and balance across activities, our measure of diversity must increase in the number of activities as well as in their even distribution of time.

While the simple count of activities puts all the weight on variety, the Gini index, for example, puts all the weight on balance (i.e. it is not sensitive to the number of activities over which it is measured). The most commonly applied diversity measure that encompasses both variety and balance is the Shannon-Wiener (S-W) index of ecological diversity. A similar measure in the economics literature is the Herfindahl-Hirschman Index (HHI), also known as the Simpson Index of market concentration. In the context of time-use, we choose to use the S-W index, given in Equation 1, rather than the HHI for two main reasons: (a) the S-W index weighs activities precisely by their frequency, without disproportionately weighing common activities, as opposed to the HHI (Jost, 2006); (b) with the S-W, the rank ordering of time use portfolios is not sensitive to changes in the index parameters (either the logarithm base or the exponential power) (Stirling, 1998).⁴

$$D^{SW} = - \sum_{i=1}^S p_i \ln(p_i) \quad (1)$$

The S-W index weights activities by the time allocated to them relative to the total amount of available time in the following manner: total time during a day is divided into S categories, and p_i denotes the share of time spent on category i . We define total time during a day as the number of minutes a day (1,440) minus the number of minutes dedicated to sleep. To compute the S-W index for each diary day, we sum over activities with positive time shares $p_i > 0$, meaning that the diversity index is constructed over a potentially different subset of activities for each individual. The SW-index increases in the number of activity categories S with a positive share, as well as when these single shares are distributed relatively equally among the performed categories. It thus, takes into account two dimensions of diversity: it penalizes the presence of very dominant activities (with high shares) and increases with the number of activities performed.

Disparity. When determining the set of activities over which people diversify, one faces a trade-off between using a fine classification, separating tasks that may be part of the same category in terms of the individual experience (e.g. laundering and ironing clothes), and coarse classifications that lump together inherently different activities (i.e. sport and watching TV under the category of leisure). Clearly, any classification of activities is limited to the activity definition

used in the survey. In this paper we use the two-digit classification of activities defined by the French statistical office (INSEE) for the FTUS, and align the ATUS data accordingly, in order to make the country level analyses comparable.⁵ Gronau and Hamermesh (2008) focus on variety in what they define as "non-work" activities. However, in terms of diversity, we expect the work-life balance to play an important role. Therefore, in our measure of diversity, we include all activities except for the share of time dedicated to sleep, as it accounts on average for 35% of a day time, so that variation in sleeping time might dominate the index. We include sleeping time as a control in our regressions. The results of our analysis do not change in a meaningful way when replacing diversity without sleep to diversity with sleep.

Finally, any measure of diversity clearly depends on the time over which individuals diversify. Admittedly, diversity within a single day is likely to be a very noisy indicator for overall diversification, as people may specialize within days and still diversify over weeks or months. However, we are limited by available time-use data, which refer to a single day in the ATUS and two days (a weekday and a weekend) in the FTUS. Therefore, we consider our measure as a lower bound of the degree of diversity for individuals who diversify over larger units of time. However, we also take advantage of the feature of the FTUS that interviews each individual twice. This allows us to construct measures of diversity based on each diary, as well as on the two diaries pooled together. For robustness, we also use a simple measure of variety, i.e. the number of different activities undertaken by respondents.

2.2 Measures of Subjective Well-Being

In the abundant literature dedicated to subjective well-being, self-declared life satisfaction has emerged as the standard metric, one that includes both a cognitive judgemental dimension and a hedonic dimension (van Praag et al., 2003; Layard, 2011). Self-reported evaluations of time episodes, on the other hand, are now classically seen as measures of momentary utility (Gershuny and Halpin, 1996; Robinson and Godbey, 1999), process benefits (Stratton, 2012), or ecological momentary assessments (Stone et al. 1999). They have been conceptualized as “experienced

utility” (Kahneman et al. 2004), i.e. ex-post utility, as opposed to ex-ante decision-utility. Krueger et al. (2009a) have used them to produce so-called National Time Accounts (NTA) that allow comparisons of “evaluated time episodes” across countries, over time, or between groups of people.

The relationship between momentary utility and life satisfaction has also received some attention. Most studies see a disconnect between the two types of measures. Krueger et al. (2009b) for instance, find that American women report higher levels of life satisfaction than French women but that the French spend their days in a more positive mood, on average, and spend more of their time in activities that are more enjoyable. In their eponymous article, Knabe et al. (2010) also note that the unemployed are “dissatisfied with life but having a good time” during weekdays. We use self-declared life satisfaction, as measured by the Cantril scale as our main outcome of interest, and we exploit measures of momentary utility to test the relationship between activity duration and affect.

3 Estimation Strategy

3.1 The Relationship between Life Satisfaction and Time-Use Diversity

Hypothesis [H1] addresses the relationship between life satisfaction LS_{iw} of individual i in survey time w , measured on the Cantril scale, and time-use diversity, as measured by the S-W index SW_{iw} . The Cantril scale is an ordinal measure of life satisfaction with no clear interval properties. Therefore, for the estimation of the relationship, we convert responses into a binary variable indicating whether respondents ranked their life satisfaction above the sample mean. Our main estimation equation is presented in Equation 2:⁶

$$Pr[LS_{iw} \geq \overline{LS}_{iw}] = \beta_0 + \beta_1 SW_{iw} + \beta_2 SW_{iw}^2 + X'_i \gamma + w + \epsilon_i \quad (2)$$

Our coefficients of interest are β_1 and β_2 , allowing for a non-linear relationship between diversity and life satisfaction. We expect β_1 to be positive, and β_2 to be negative. This

would correspond to a concave relationship between activity diversity and subjective well-being, following the idea that diversifying one's daily schedule is conducive to a higher level of satisfaction, up to a certain optimal point. Given that our measure of diversity increases in the number of activities, one could imagine that after a given threshold, adding activities yields more stress or other negative emotions than hedonic benefits. We estimate Equation 2 on various sub-samples (by country, weekday, etc.) in order to examine potential heterogeneity in the nature of the relationship.

While our analysis of this relationship is descriptive in nature, we include in our estimation all relevant observable individual characteristics X_i that are likely related to both life satisfaction and time-use diversity. One obvious example is income level, which exhibits a positive relationship with life satisfaction as demonstrated by Easterlin (2001) and enables a diversification of one's leisure portfolio (Gronau and Hamermesh, 2008). On the negative side, people suffering from chronic health conditions that lower their life satisfaction (Steptoe et al., 2015) are also likely to be limited in their ability to engage in a number of activities. Finally, some characteristics may affect life satisfaction and diversity in different directions. For instance, full time employment may boost life satisfaction, as it reflects social worth, but may limit time-use diversity due time crunch. To address such interconnections, our full specification includes controls for observable individual characteristics that are available in the two surveys. Additionally, we include fixed effects w for the timing of the survey, and a quadratic function of time slept, as the latter is not included in our diversity measure.

3.2 Hedonic Returns to Time in Activity

Hypothesis [H2] asks whether the returns to the duration of an activity are convex (increasing) or concave (decreasing). If the former is true, concentration on a few activities is conducive to higher subjective well-being; if it is the latter, then time-use diversity is preferable. In order to test hypothesis [H2], we estimate the relationship between the duration of an activity episode and the momentary utility (MU) reported for that episode, and we do so both across and within individuals.

We begin with a cross-sectional, minimally parametric estimation strategy, Restricted Cubic Spline (RCS) regression, relating reported momentary utility MU_{ijw} of respondent i during activity j occurring on survey day w as a function of time t spent in activity j on the same day.⁷ This allows us to examine the relationship without assuming its shape. The relationship will thus be estimated across individuals.

Ideally, we would like to estimate this relationship "within-individual". However, the short duration of observation in time-use survey limits this ability. We can however exploit the two day structure of the FTUS and estimate the relationship between momentary utility and episode duration with individual fixed effects, as shown in Equation 3:

$$Pr[MU_{iwa} = \max(MU)] = \alpha_0 + \alpha_1 time_{iwa} + \alpha_2 time_{iwa}^2 + \eta_i + \theta_w + \epsilon_i \quad (3)$$

For each activity type a we estimate α_1 and α_2 to test for increasing returns, conditional on individual fixed effects η_i and a weekend constant θ_w . While this is a more direct way to test for hedonic returns to time, it severely limits the sample as it includes only individuals who took up an activity on both days (for instance, because one day is always a weekend, there will be few observations for time in work), and whose reported momentary utility varies across both days. Therefore, we use both within and across individual approaches to examine hypothesis [2].

3.3 Diversity, Well-Being and Gender

In order to test hypothesis H3, we simply measure the difference between men and women in terms of the S-W index of activity-diversity. To test hypothesis H4, we introduce the S-W diversity index together with the female indicator in the estimates of life satisfaction, as in equation 2. If this reduces the magnitude of the coefficient on the female indicator, this will suggest that women's higher life satisfaction is partly due to the greater diversity in their time allocation.

Finally, to test hypothesis H5, we ask whether the relationship between diversity and life satisfaction varies between men and women, indicating gender differences in preferences regarding

time allocation. If not, we will interpret the lower activity-diversity and greater concentration of men's time on paid-work as a constraint, rather than a revealed preference. To do this, we estimate equation 2 separately on the sub-samples of men and women and ask whether the coefficients on the S-W index differ.

4 Data

We use two sources of data: the 2012 and 2013 waves of the American time-use survey (ATUS) and the 2010 wave of the French time-use survey (FTUS). Each of these waves includes a well-being module, in addition to detailed time-use diaries. In each survey year, only a sub-sample of respondents were asked to fill in the well-being module.⁸ Table 1 shows the descriptive statistics for the sample of respondents who were included in the well-being module and completed the survey for at least one full day.⁹ The sample size is substantially larger in the ATUS, 19,198 individuals, with each individual reporting activities for one day. The FTUS sample is substantially smaller, 1,222 individuals, but nearly all respondents, 95%, supplied diaries over two days, one during the week and one over the weekend.

The table includes population weighted means and standard deviations for the set of observable characteristics for which the literature has established a strong link with subjective well-being. In both countries, over 60% live with a partner and around 40% live with children, and in both cases the rate is slightly higher in France relative to the USA. In both countries, families with children have on average two children. We define three major age groups that correspond to the different stages of the life cycle: age 18-25 accounts for 12-14% of the population (and of the weighted sample) and includes students and early labor market entrants;¹⁰ age 25-55 includes the main working ages and accounts for more than half of the population; and finally individuals above age 55 is the group transitioning into retirement and accounts for a third of the population. The average age in both surveys is 45.

With respect to work, the two surveys reveal some differences. Two thirds of the ATUS population is employed, compared to 56% in the FTUS. In both countries, a fifth of employed individuals work part-time. The share of retired individuals and students is higher in the FTUS, while unemployment rates are similar. The average monthly income is nearly 6,000 USD in the ATUS and 3,000 EUR in the FTUS.¹¹

Both surveys include the same question about health “Would you say your health in general is excellent, very good, good, fair, or poor?”, with answers ranging from 1 ‘excellent’ to 5 ‘poor’. Additionally, they both include a binary question on whether a person had a disability or permanent illness. On average the French respondents score their health as “very good” (2.06) and the Americans as between “very good” and “good” (2.52).¹² In the ATUS, 5 percent of respondents report having a disability, while the corresponding figure in the FTUS is much larger: 35 percent of respondents declare that they suffer from a chronic or permanent disease, as illustrated by Table 1. As this is substantially higher than the official rate of invalidity, we consider this measure as less precise than the disability indicator of the ATUS.¹³

4.1 Measures of Subjective Well-Being and Diversity

Both the American and the French surveys include, for each respondent, one measure of self-declared life satisfaction (LS) measured on a (0-10 steps) Cantril scale.¹⁴ In both surveys, this question is asked once, even though in the French survey each person fills a time-diary for two different days. Figure 1 displays the (weighted) distribution of life satisfaction for each country. We see that in both countries the modal response is eight on a zero-ten scale. The distribution of answers is skewed to the right, and more so among the French. The top panel of Table 2 shows that the average life satisfaction is slightly higher among the FTUS respondents compared to the ATUS. ATUS respondents declare a similar level of life satisfaction whether they are surveyed on weekdays or weekend. Due to the ordinal nature of this measure, we convert the scale into a binary measure indicating whether an individual ranked their life satisfaction above the sample mean which is 7 (closest integer). Here we see a substantive difference between French and American

Table 1: Descriptive Statistics - Individual Characteristics, by Country

	ATUS	FTUS
	(population weights)	
N	19,198	1,222
Weekend/Both ^a	0.52	0.95
Female	0.51	0.51
Living with partner	0.61	0.65
Has children	0.38	0.42
N children ^b	1.90	1.89
	(1.03)	(1.1)
<i>Age group</i>		
15-24	0.12	0.14
25-54	0.57	0.54
55+	0.31	0.32
age	45.08	45.27
	(15.89)	(16.4)
<i>Employment status</i>		
full-time	0.52	0.44
part-time	0.15	0.12
unemployed	0.06	0.08
retired	0.13	0.20
student	0.02	0.08
other	0.13	0.08
Monthly income (USD/EURO)	5911	3034
	(4951)	(1831)
Disability	0.05	0.35
Health (1-5)	2.52	2.06
	(1.04)	(0.84)

Note: Descriptive statistics calculated using a single observation per respondent and weighted using population weights.

^a For the ATUS: share of respondents who document time use on a weekend day. For the FTUS: share of respondents filling out time-use journals on two days.

^b Number of children among individuals with children.

Data source: ATUS, 2012 and 2013; FTUS, 2010

respondents, where 78 percent of the French rank their satisfaction as 7 or higher, compared to 66 percent of Americans.

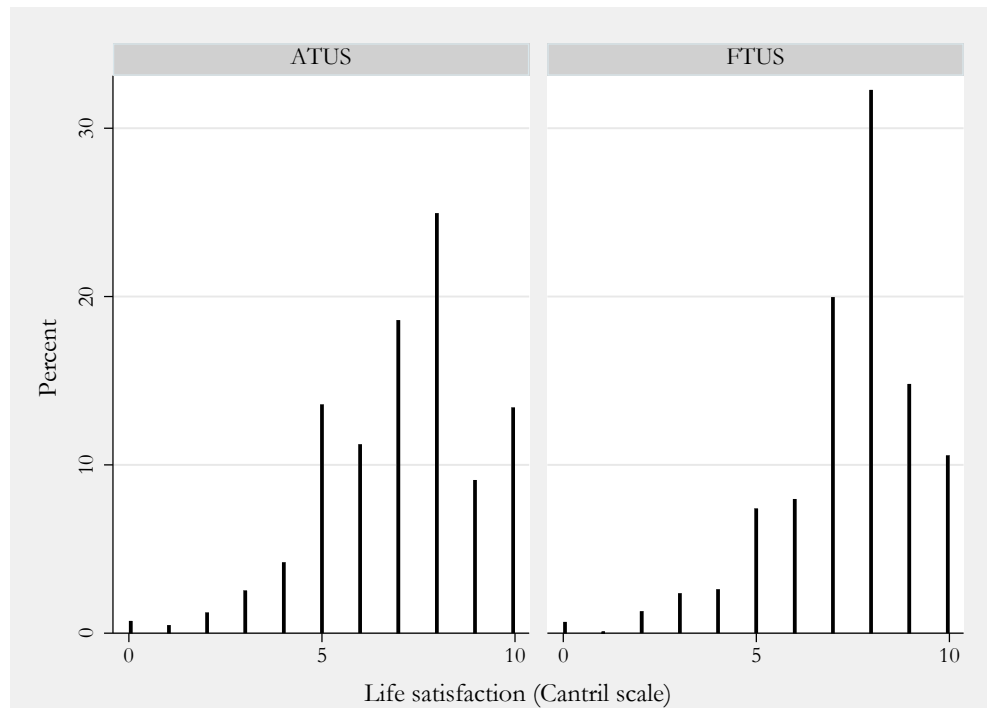


Figure 1: Distribution of Life Satisfaction

Note: Sample distributions using population weights, single response per individual. FTUS: "How satisfied are you with your life?". ATUS: "Please imagine a ladder with steps numbered from zero at the bottom to ten at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. If the top step is 10 and the bottom step is 0, on which step of the ladder do you feel you personally stand at the present time?"

Data source: ATUS, 2012 and 2013; FTUS, 2010

The middle section of Table 2 shows measures of variety and diversity of activities by country and week of the day. These measures are calculated on the two-digit classification that contains 29 activity categories, as detailed in Appendix Table A1. The declared number of activities is slightly higher in the FTUS compared to the ATUS, and slightly higher on weekdays compared to weekends. Our preferred measure of diversity, the S-W index without sleep, is also higher in the FTUS and is higher on weekends than weekdays in both countries. (This reflects the difference between variety and diversity). Figure 2 displays the distribution of our measure of diversity by country and weekend-weekday, in the French and American samples. The shapes

Table 2: Descriptive Statistics - Subjective Well-Being and Time-Use, by Country

	ATUS		FTUS	
	Weekday	Weekend	Weekday	Weekend
N	9,267	9,931	1,247	1,250
Life satisfaction- Cantril scale^a				
Score	7.10 (2.03)	7.05 (2.01)	7.42 (1.83)	
Score 7 (sample mean) or higher	0.66 (0.47)	0.66 (0.48)	0.78 (0.42)	
Diversity- single day				
Number of activities (29 categories) ^b	8.47 (2.13)	8.03 (2.17)	8.54 (1.88)	8.42 (1.94)
Shannon-Wiener Index - w/o sleep	4.53 (1.67)	4.66 (1.83)	5.34 (1.74)	5.54 (1.74)
Shannon-Wiener Index - all activities	4.98 (1.30)	4.88 (1.40)	5.56 (1.27)	5.62 (1.30)
Diversity- two days (only FTUS)				
Number of activities (29 categories)			10.44 (2.20)	
Shannon-Wiener Index - w/o sleep			5.28 (1.69)	

Note: Descriptive statistics calculated using population weights. For weekend/weekday means are calculated using a single observation per respondent per weekday/weekend. Two-day diversity measures are calculated only for FTUS respondent who completed two journals.

^a Life satisfaction measured on a (0-10) scale.

^b Detailed categories are presented in Table A1 in the appendix.

Data source: ATUS, 2012 and 2013; FTUS, 2010

of the distributions are strikingly similar. The American curve is slightly more concentrated, as compared with the French one, and in both countries, the curves are shifted to the right on weekends, as compared to weekdays. In the bottom panel of Table 2, we see that, as expected, pooling weekends and weekdays (in the FTUS) increases the measured number of activities, but not the S-W index.

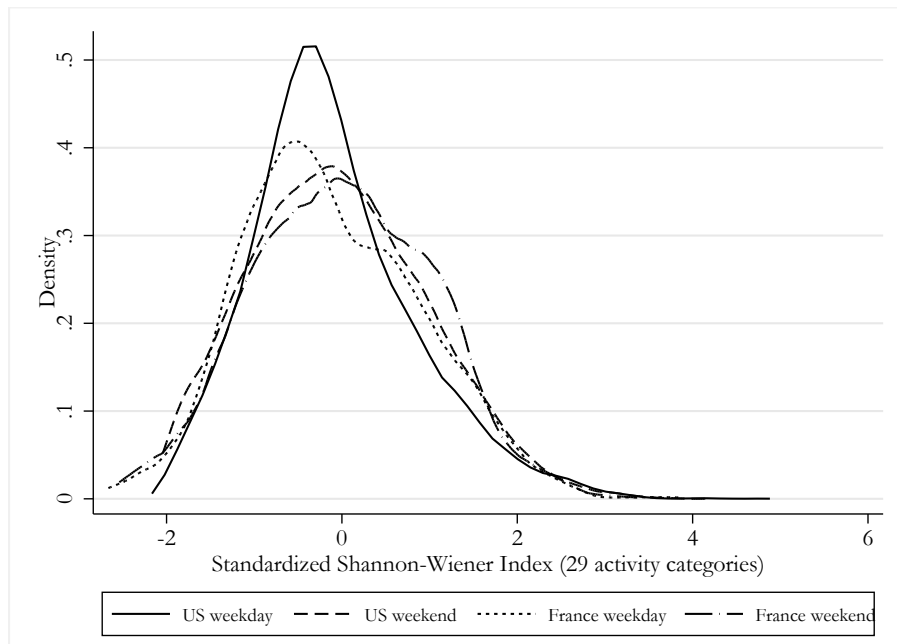


Figure 2: Distribution of the S-W Index, by Weekday/Weekend

Note: Sample distributions using population weights. Distribution of Shannon-Wiener Index of diversity by country and weekday using Epanechnikov kernel function with bandwidth 0.266.

Data source: ATUS, 2012 and 2013; FTUS, 2010

Figure 3 examines the relationship between our S-W measure of diversity (over one day for the ATUS and over 2 days for the FTUS) and the covariates described in Table 1. Because of the much smaller size of the French data, we tend to be more confident in the analysis of heterogeneity that is based on the American data. Panel (a) confirms the expected greater time-use diversity of part-time employed and unemployed people as compared to full-time workers. In the FTUS, this is also true of retired people. In the other panels, clear patterns appear only in the American data. Panel (b) shows the positive income gradient of activity-diversity. Panel (c) shows no clear pattern in terms of time-use diversity depending on age. Panel (d) shows the positive gradient of S-W in

health. Finally, panel (d) illustrates the greater activity-diversity of people who live with children or a partner, and the smaller diversity index of people with a disability.

4.1.1 Activities and Momentary Utility

Table 3 displays the average daily composition of time-use in both countries, for weekdays and for weekends, based on the one-digit level classification. The first two columns present the share of respondents who reported dedicating any positive amount of time to each activity. In both countries, nearly all respondents dedicated at least some amount of time to sleep, meals, and relaxing and hobbies (this category includes watching TV and doing nothing), and over 80 percent also dedicated time to personal care, domestic work, and commuting. Half of ATUS respondents and only a third of FTUS respondents reported dedicating time to paid work related activities and about a third of each sample dedicated time to care work, roughly corresponding to the share of respondents with children.

The most time consuming activities are sleep, work and education, followed by relaxing and domestic work, which account for about three hours each (on average, per day). As expected, in both countries, the most prominent difference between weekends and weekdays is the share of time allocated to paid work. On average, American respondents dedicate a larger share of their time to work and work-related activities, and the French spend more time on meals. The time dedicated to social activities increases by 50 percent on weekends, as compared to week days, and the same is true of time dedicated to sports and recreation.

The leftmost columns of Table 3 display the average pleasantness score attributed to each category of activity, as in Kahneman and Krueger (2006). In the ATUS, momentary utility (MU) is, in principle, measured for three randomly drawn activities per respondent. Respondents are asked to indicate the duration of the activity and evaluate it in terms of: level of pain, tiredness, sadness, stress, and happiness, as well as how meaningful the activity is- each on a 0-6 scale. We aggregate these evaluations into an average score of MU, as displayed in Table 2. However, the ATUS documentation acknowledges that, due to a programming error in the data collection

software, certain activities were less likely than others to be selected for follow-up questions in the well-being module.¹⁵ For this reason, the MU information based on the ATUS presented in Table 2 should be interpreted with caution. In the French survey, respondents were asked to assess the pleasantness of all of the episodes experienced during an entire weekday and weekend day, each day being divided into slots of 10 minutes. For each episode, they are asked to indicate: “*was it a pleasant or unpleasant time? (from -3 very unpleasant to +3 very pleasant)*”.

As can be seen, in both countries, sports and recreation activities, and attending events are the most appreciated activities. In France, these are followed by eating and drinking, social relations, and relaxing, whereas among ATUS respondents, care work is associated with relatively high momentary utility, ranking third in terms of pleasantness. In both countries, education, work, domestic work, and travel rank last in terms of MU.

4.1.2 Life satisfaction, Time-Use and Gender

Table 4 shows our measures of life satisfaction by country and gender. In the USA, women report slightly higher life satisfaction than men, while in France there are no gender differences in life satisfaction (but there are, once controls are introduced, as will be shown by Table 5). On the other hand, gender differences in time allocation are well documented. Figure 5 shows the distribution of time spent over categories of activities by country and gender.¹⁶ Within each country, women dedicate a lower share of their time to market work. The opposite is true for domestic and care work, to which women dedicated more time than men. The gender differences with respect to this unpaid work are larger than those in paid work. The final substantive difference between men in women is with respect to the share of time dedicated to leisure which is substantially larger among men in both countries.

Whether the observed gender differences in time-use imply gender differences in diversity is examined in Table 4. We see that women in both countries take up more activities and exhibit higher diversity in their time-use. In light of the gender differences in time dedicated to paid work, which may limit men’s ability to diversify, we calculate diversity over non-work time (and still

Table 3: Time-Use Categories and Momentary Utility

	% reporting		Average time (hours) ^a				Average MU	
	ATUS	FTUS	ATUS		FTUS		ATUS ^b -6 to 6	FTUS ^c -3 to 3
			Weekday	Weekend	Weekday	Weekend		
Sleep	1.00	1.00	8.37 (2.06)	9.25 (2.24)	8.32 (1.84)	8.66 (1.87)		
Meals	0.96	0.99	1.11 (0.75)	1.28 (0.94)	2.11 (1.11)	2.69 (1.55)	3.43 (2.16)	2.17 (0.71)
Relaxing and hobbies	0.91	0.91	3.95 (3.06)	4.91 (3.41)	3.36 (2.33)	3.93 (2.66)	3.17 (2.23)	2.05 (0.85)
Personal care	0.81	0.95	1.01 (1.01)	0.99 (1.04)	0.95 (0.67)	0.99 (0.64)	1.02 (3.11)	1.44 (1.04)
Domestic work	0.84	0.85	2.46 (2.35)	3.22 (2.63)	3.31 (2.48)	3.50 (2.32)	2.98 (2.23)	1.25 (1.08)
Commuting	0.86	0.81	1.40 (1.19)	1.45 (1.45)	1.40 (1.07)	1.38 (1.11)	3.17 (2.16)	1.32 (1.02)
Social activities	0.48	0.52	1.73 (1.75)	2.89 (2.39)	1.62 (1.59)	2.40 (2.06)	3.53 (2.34)	2.26 (0.91)
Work	0.48	0.33	7.86 (2.84)	5.42 (3.88)	7.08 (2.94)	5.72 (3.55)	2.46 (2.18)	1.07 (1.27)
Care work	0.37	0.26	1.77 (1.95)	1.87 (2.14)	1.79 (1.55)	1.55 (1.34)	3.57 (2.03)	1.94 (1.01)
Sports and recreation	0.18	0.28	1.39 (1.32)	2.05 (2.00)	1.77 (1.27)	2.25 (1.76)	3.80 (1.81)	2.31 (0.85)
Education	0.05	0.06	5.08 (3.59)	4.00 (2.92)	5.47 (3.50)	5.12 (3.25)	1.84 (2.19)	0.82 (1.25)
Events and cultural activities	0.04	0.06	2.48 (1.47)	2.92 (1.89)	2.57 (1.98)	2.44 (1.29)	4.09 (1.97)	2.54 (0.77)

Note: Descriptive statistics calculated using population weights. For weekend/weekday, means are calculated using a single observation per respondent. Share reporting and Average MU refer to each respondent's scores over all time-use diaries.

^a Average time in activity is calculated only over individuals spending at least some time in that activity.

^b For the ATUS, average MU is the aggregated net-affect score (pain, tiredness, sadness, stress, and happiness) on a scale of -6 to 6 for three randomly chosen episodes throughout the day.

^c For the FTUS, MU is the average score over all episodes of a given activity within the two days, answering the question: "was it a pleasant or unpleasant time? (from -3 very unpleasant to +3 very pleasant)".

Data source: ATUS, 2012 and 2013; FTUS, 2010

without sleep) and find that womens S-W index is stil substantially higher. Finally, the gender gap remains when we compute our index of diversity over the two days (weekday and weekend) over which respondents are interviewed in the FTUS.

Table 4: Descriptive Statistics - Life satisfaction and Diversity, by Country and Gender

	ATUS		FTUS	
	Men	Women	Men	Women
Life satisfaction- Cantril scale^a				
Score	6.97 (2.02)	7.18 (2.02)	7.44 (1.75)	7.44 (1.88)
Score 7 (sample mean) or higher	0.65 (0.48)	0.67 (0.47)	0.78 (0.41)	0.78 (0.42)
Diversity- single day				
Number of activities (29 categories) ^b	7.89 (2.05)	8.76 (2.16)	8.02 (1.92)	8.91 (1.79)
Shannon-Wiener Index - w/o sleep	4.14 (1.56)	4.97 (1.77)	4.92 (1.65)	5.94 (1.69)
Shannon-Wiener Index - w/o sleep and work	4.3 (1.62)	5.14 (1.77)	4.87 (1.64)	5.9 (1.57)
Diversity- two days (only FTUS)				
Number of activities (29 categories)			10.03 (2.33)	10.82 (2)
Shannon-Wiener Index - w/o sleep			4.73 (1.55)	5.79 (1.65)

Note: Descriptive statistics calculated using population weights. For weekend/weekdays, means are calculated using a single observation per respondent. Two-day diversity measures are calculated only for FTUS respondent who completed two diaries.

^a Life satisfaction measured on a scale of 0-10

^b Detailed categories are presented in Table A1 in the Appendix.

Data source: ATUS, 2012 and 2013; FTUS, 2010

5 Estimation Results

5.1 Time-Use Diversity and Subjective Well-Being

The determinants of life satisfaction in both surveys, following equation 2, are presented in Table 5. The columns of the table display the estimates on the entire samples, with and without controls,

where, for the French data, the index of activity-diversity is calculated over the weekend and weekday pooled. The top panel of Table 5 presents the average marginal effect of an increase in the diversity index (by a standard deviation) on the probability of declaring a level of life satisfaction above the average. All the results confirm [H1], as the estimated coefficients are always positive. While the unconditional estimates differ between the ATUS and the FTUS, controlling for individual characteristics yields nearly identical marginal effects—a standard deviation increase in the S-W index is associated with a 2 percentage points higher probability of ranking at or above 7 on the life satisfaction scale. Regarding the form of the relationship, results differ between the ATUS where the relationship is concave and the FTUS where it is convex. The magnitude of the association between a standard deviation increase in time-use diversity and life satisfaction is similar to the gender difference in life satisfaction, the association with having children, or the difference between full-time and part-time employment.

Controlling for observable characteristics has a substantial effect on the estimated relationships for both samples—the coefficient of interest is reduced in the ATUS and enhanced in the FTUS. This is a result of different relationships between individual characteristics and diversity, as discussed in the previous section. Table 5 also illustrates the different correlates of life satisfaction in the two countries. For instance, in the ATUS, having children is positively related to life satisfaction, while for the French the opposite is true, echoing the finding in Table 3, where care work is associated with high MU in the ATUS. Part-time employment is beneficial to life satisfaction in France but detrimental in the US. The rest of the coefficients are “well-behaved”, in the sense that the usual correlations are found in both samples: life satisfaction is positively correlated with income, being employed, and living with a partner, and negatively associated with unemployment.

The upper panel of Table 6 displays the estimates on the sub-samples of weekdays and weekends, with individual and survey controls. The results are essentially the same, but of larger magnitude over weekends. As we have seen (Figure 2), weekdays are clearly less diverse in terms of time-use compared to weekends. The lower part of Table 6 displays the same estimates

Table 5: Probit Estimates Relating Life Satisfaction and Time-Use Diversity, by Country

	ATUS		FTUS	
	(1)	(2)	(3)	(4)
	Average marginal effects			
Diversity	0.053 (0.000)	0.018 (0.000)	0.001 (0.000)	0.019 (0.000)
	Probit coefficients			
SW_i	0.139 (0.000)	0.054 (0.000)	0.008 (0.000)	0.077 (0.000)
SW_i^2	-0.028 (0.000)	-0.005 (0.000)	0.036 (0.000)	0.032 (0.000)
Female		0.085 (0.000)		0.017 (0.001)
Living with partner		0.314 (0.000)		0.485 (0.001)
Has children		0.067 (0.000)		-0.050 (0.001)
Part-time employment		-0.075 (0.000)		0.047 (0.001)
Unemployed		-0.402 (0.000)		-0.812 (0.001)
Retired		0.116 (0.000)		0.139 (0.001)
Income		0.078 (0.000)		0.139 (0.000)
Health status "very good"		-0.234 (0.000)		-0.232 (0.001)
Has disability		-0.206 (0.000)		-0.034 (0.001)
Constant	0.434 (0.000)	-0.155 (0.000)	0.703 (0.000)	-0.333 (0.004)
Observations	19198	19198	1222	1218

Note: The dependent variable is whether and individual scored their life satisfaction at 7 or above (7 is the closest integer value to sample mean). All estimates are obtained using a probit regression weighted by population weights for each survey. The S-W index is calculated for a single day in the ATUS and over two days in the FTUS. The top panel presents calculated average marginal effects for a standard deviation change in the S-W index, standard errors calculated using the delta method. The lower panel presents probit coefficients for the main variables of interest. All regressions include controls for survey waves (12 in the ATUS and 3 in the FTUS) as well as year and weekend dummies (ATUS only). Columns (2) and (4) include controls for seven age categories, where the omitted category is 45-54, and a second degree polynomial of sleeping time. For employment status, the omitted category is "full-time", and coefficients for "student" and "other" are suppressed. The omitted category for health status is "Excellent (1)", and coefficients for "good (3)", "fair (4)" and "poor (5)" are suppressed.

Data source: ATUS, 2012 and 2013; FTUS, 2010

separately on the sub-samples of working-age people (25-55) and of respondents aged 55 and above. The results are similar, and of similar magnitude in both age ranges.

For robustness, we also estimate these relationships using the number of different activities undertaken by respondents, i.e. an indicator of variety, instead of the S-W index of diversity. The results are displayed in Appendix Table A2.

5.2 Returns to Time Spent on Activities

Are there increasing hedonic returns to scale with respect to the time spent on a given activity? We test this hypothesis (H2) using scores of momentary utility as measured in the FTUS. For this section, we only use the French data (FTUS) where the pleasantness of an episode is scored from -3 'very unpleasant' to +3 'very pleasant' (see Section 4.1.1)

Figure 7 illustrates the relationship between momentary utility associated with a given type of activity and the amount of time spent on that activity over the span of two days (conditional on the usual controls). As can be seen, no relation is convex. Some have a concave shape, e.g. meals, personal care, relaxing and hobbies (which includes a large chunk of TV watching), or work. Others have a more irregular shape, e.g. recreation and sports.

Figure 7 shows the cross-sectional relationship between the duration of an activity and MU by comparing different individuals. However, ideally, we would like to estimate this relationship "within individual". As explained in Section 3.2, we dichotomize the pleasantness score and estimate a logit model of MU over the duration of an activity, with two observations per person, i.e. weekend and weekday. This allows us to introduce individual fixed-effects.

Table 7 displays these estimates. Each column refers to an activity category. The size of the regression sample is reduced because the estimates can only be performed on individuals who scored the same activity on both reporting days, and whose reported momentary utility varied across these two days. It turns out that most estimated relations are concave, i.e. the coefficient on the duration of the activity is positive and the coefficient on the squared duration term is negative (both statistically significant). The exception is care work, where the coefficient on

Table 6: Probit Estimates Relating Life Satisfaction and Time-Use Diversity, by Weekday and Age Group

	ATUS		FTUS	
	Weekday	Weekend	Weekday	Weekend
	Average marginal effects			
Diversity	0.016 (0.000)	0.022 (0.000)	0.019 (0.000)	0.030 (0.000)
	Probit coefficients			
SW_i	0.046 (0.000)	0.066 (0.000)	0.080 (0.000)	0.115 (0.000)
SW_i^2	-0.008 (0.000)	0.001 (0.000)	0.027 (0.000)	-0.010 (0.000)
Observations	9267	9931	1243	1246
	Age 25-55		Age 55+	
	Average marginal effects			
Diversity	0.017 (0.000)	0.016 (0.000)	0.019 (0.000)	0.015 (0.000)
	Probit coefficients			
SW_i	0.052 (0.000)	0.051 (0.000)	0.076 (0.000)	0.057 (0.001)
SW_i^2	-0.005 (0.000)	-0.014 (0.000)	0.021 (0.000)	0.051 (0.000)
Observations	11484	6562	637	495

Note: The dependent variable is whether an individual scored their life satisfaction at or above the score of 7 (the closest integer value to sample mean). All estimates are obtained using a probit regression weighted by population weights for each survey. The S-W index is calculated for a single day in the ATUS and over two days in the FTUS. Average marginal effects are presented for a standard deviation change in the S-W index, standard errors calculated using the delta method. The top panel splits the sample by whether time-use was reported for a weekday or weekend. The bottom panel splits the sample by the two largest age groups. All regressions include controls for survey waves (12 in ATUS and 3 in FTUS) as well as year and weekend dummies (ATUS only), a continuous measure of household income, a second degree polynomial of sleeping time and indicators for: gender, cohabitation, presence of children, employment status, age categories (each category over 10 years), health status and disability. *Data source:* ATUS, 2012 and 2013; FTUS, 2010

Table 7: Momentary Utility and Activity Duration with Individual Fixed Effects

	Personal care care	Meals	Domestic work	Care work work	Socializing	Relaxing and hobbies	Commuting
Time in activity	0.679 (0.003)	0.955 (0.001)	0.056 (0.001)	-0.776 (0.076)	1.001 (0.001)	0.290 (0.001)	0.151 (0.001)
Time in activity ²	-0.110 (0.001)	-0.079 (0.000)	-0.002 (0.000)	1.702 (0.026)	-0.022 (0.000)	-0.022 (0.000)	-0.001 (0.000)
Weekend	0.184 (0.001)	0.474 (0.001)	0.046 (0.001)	-0.044 (0.002)	0.389 (0.001)	-0.012 (0.001)	0.365 (0.001)
Observations	454	534	362	76	162	376	348
Individuals	227	267	181	38	81	188	174

Note: Each column refers to an activity category. The dependent variable is whether and individual scored their momentary utility in that activity as 3 (the highest score). Coefficients from a logit regression with individual fixed effects, weighted by population weights. All regressions include a weekend dummies. The sample includes respondents who engaged in an activity category in both reporting days and whose reported momentary utility varied between both days.

Data source: FTUS, 2010

duration is negative. Table A3 in the Appendix displays OLS estimates on the continuous life satisfaction scale, with similar results, although less statistical power. (Note that people enjoy pleasant activities more during weekends than during weekdays). Hence, hypothesis H2 is not validated by the data; rather, it seems that, for pleasant activities, the relationship between duration and momentary utility exhibits decreasing marginal returns.

5.3 Activity-Diversity and Gender

We now turn to the gender dimension of the association between activity-diversity and life satisfaction. As was shown by Table 4, our measure of time-use diversity is systematically higher for women than for men. The upper panel of that Table showed that the unconditional level of life satisfaction is higher for women than for men in the American sample, but, surprisingly, not in the French ones. However, the first column in Table 8 shows that the average marginal effect of the female indicator on life satisfaction is positive in both samples, once individual characteristics

are controlled for. Introducing the S-W index of diversity into the estimates in the second column reduces the average satisfaction level of women relative to that of men, by about 10 percentage points in the ATUS and by 18 percentage points in the FTUS, as can be seen from the comparison of the second and third columns. The same patterns hold when the estimates are over the sub-samples of weekends and weekdays. These results suggest that the greater diversity of women's time-use contributes to their subjective well-being, and that it explains part of the gender gap.

But could the satisfaction that women derive from activity-diversity be due to the specific composition of their schedule, namely the fact that they devote a large amount of time to care and household work? The fourth column in Table 8 addresses this question and shows that it is not the case, in either country. It displays the estimates of equation 2 including a measure of the time spent on care (including child care) and household work. Including this measure in the regression does not explain away the positive gender gap in life satisfaction. On the contrary, this even increases the coefficient on the female indicator, suggesting that the higher level of women's satisfaction is not due to this part of their schedule. Similarly, the coefficient on diversity is larger when this measure of the time spent on care work is controlled for, which suggests that the hedonic benefit of activity-diversity is not only due to a preference for such tasks.

If activity-diversity is a factor in life satisfaction, why is it less developed among men than among women? Is it the result of different preferences or different constraints? The last two columns of Table 8 show that the association between the S-W index and life satisfaction is the same among men and women in the ATUS (0.020 and 0.021). This suggests that this relationship is general, and not due to gendered preferences. In the French sample however, the coefficient on S-W is about 50 percent greater in the estimates on the sub-sample of women, as opposed to men. The same patterns hold on the sub-samples of weekends and weekdays (not shown). We also checked that the coefficient on diversity is higher for both men and women, when we include the measure of time spent on care and housework, than when this measure is not included (not shown for space reasons).

Table 8: Gender, Activity-Diversity, and Life Satisfaction

	All	All	All	Men	Women
Female	0.035 (0.000)	0.028 (0.000)	0.030 (0.000)		
SW_i		0.018 (0.000)	0.023 (0.000)	0.020 (0.000)	0.021 (0.000)
Controls					
Time FE	yes	yes	yes	yes	yes
Individual characteristics	yes	yes	yes	yes	yes
Time in HH & Care			yes	yes	yes
Observations	19198	19198	19198	8598	10600
	All	All	All	Men	Women
Female	0.014 (0.000)	0.004 (0.000)	0.008 (0.000)		
SW_i		0.019 (0.000)	0.025 (0.000)	0.026 (0.000)	0.041 (0.000)
Controls					
Time FE	yes	yes	yes	yes	yes
Individual characteristics	yes	yes	yes	yes	yes
Time in HH & Care			yes		
Observations	1218	1218	1218	569	647

Note: The dependent variable is whether an individual scored their life satisfaction at or above the score of 7 (the closest integer value to sample mean). Coefficients are average marginal effects for a standard deviation change in the S-W index, and are derived from a probit regression weighted by population weights for each survey. The S-W index is calculated for a single day in the ATUS and over two days in the FTUS. Average marginal effects are presented, with standard errors calculated using the delta method. The top panel reports results for the ATUS sample, and the bottom panel for the FTUS. The last two columns are estimated on the sample of men and women separately. All regressions include controls for survey waves (12 in the ATUS and 3 in the FTUS), as well as year and weekend dummies (ATUS only), a continuous measure of household income, a second degree polynomial of sleeping time, and indicators for: gender, cohabitation, presence of children, employment status, age categories (each category over 10 years), health status and and disability.

Data source: ATUS, 2012 and 2013; FTUS, 2010

Hence, the taste for diversity is not specific to women, although it seems higher for women in the French sample. It is true that women have a more diverse schedule, and that schedule-diversity is associated with higher life satisfaction. But this relationship holds for both men and women. It also does not reflect a specific taste for care and housework.

Overall, the results of this section indicate that the greater diversity of women's time use contributes to their subjective well being, and that it explains a significant part of the gender gap. The greater diversity of women's daily schedule cannot be attributed to a difference in preferences; rather, it points to the different constraints weighing on men's and women's time-use.

6 Conclusions

This study presents a first descriptive approach to the relationship between time-use diversity and subjective well-being. We use the Shannon-Wiener Index that captures both the variety of activities as well as the balance in the distribution activities over time. We find that allocating one's time to a more diverse set of activities is associated with a higher level of life satisfaction. In the same line, we find no evidence that the relationship between momentary utility and the duration of an activity is convex, on the contrary, for most pleasant activities, the relationship is concave.

We are only able to observe the ex-post relationship between time-use diversity and subjective well-being, i.e. *ex-post experienced utility*, rather than *ex-ante decision-utility*. We document a *de facto* higher utility associated, on average, with more diversified schedules, rather than a conscious preference guiding people's time-use choices. It may be the case that some people are unaware of this relationship, and therefore under-diversify their time-use, in the same way as it has been shown that most people underestimate the negative hedonic toll of long commutes (as measured ex-post). For example, men may be less aware of this relationship than women, which would explain why their schedule is less diversified.

Indeed, women's time-use is more diversified than men's, and this partly explains their higher level of happiness, conditional on observable individual characteristics— time-use diversity

explains a fifth of the gender gap in happiness among Americans and two thirds of the (smaller) gap among the French. This does not reflect gender differences in preferences, as the positive association between diversity and subjective well-being is not specific to women. One interpretation is that the less diversified schedules of men, and their lower life satisfaction, are at least partly the outcomes of the specific constraints that weigh on their allocation of time, rather than being a reflection of their preferences.

These results have implications for gender equality policies. They call for caution about measures that would lead to the generalisation of men's typical time use, which is less diversified and more focused on paid work. On the contrary, it should be borne in mind that the structure of women's time use seems to be more conducive to happiness.

These conclusions are based on correlations rather than causal relations, and are thus open to alternative interpretations, such as reverse causality. For example, happier people, or those in a better mood, may have a higher demand for a more diversified mix of activities. In the same vein, the happiness literature has often discussed whether marriage makes people happy or whether happier people are more likely to get married, and found that causality flows both ways. Similarly, the relationship between income and happiness has been shown to go in both directions. It is likely that the same is true of the association between time-use diversity and happiness, but this remains to be established by future work. For the moment, this paper shows that a more diversified time-use is, on average, the sign of a happier life style.

This finding opens an avenue for thinking about time, not only as an input for producing some outcome, but as a commodity in itself. Our choices in terms of time allocation turn the total amount of abstract time that is available to each of us into a certain set of experiences. This paper shows that in order to maximize one's total "utility" or happiness, it is not enough to spend more time on pleasant activities. The sequencing of these episodes also matters, and so does the general structure of one's schedule.

Notes

¹An additional reason why people who have a more diversified mix of activities are happier could be that this complexity goes together with a greater degree of autonomy and control over one's organization, hence a greater sense of agency –known to be an important driver of happiness.

²Karl Marx, *The German Ideology / Theses on Feuerbach / Introduction to the Critique of Political Economy*, 1845

³See the surveys of cultural gender norms by Fernández (2013); Goldin (2014); or Giuliano (2020).

⁴See also Jost (2006).

⁵While quite close, the American and French classifications of activities differ, as the former was elaborated by the US Bureau of Labor Statistics, and the latter by INSEE. Our common classification at the 1 and 2-digit levels, largely following the INSEE classification, can be found in Table A1 in the Appendix.

⁶For robustness, we also use ordered probit estimates of life satisfaction, keeping the entire scale.

⁷The Equation of the RCS is given below. For maximum flexibility we use $k = 5$ knots s for the spline at Harrell's recommended percentiles—at the 5th, 27.5th, 50th, 72.5th and 95th percentiles of time in the activity (Frank E. Harrell Jr, 2015).

$$\text{MU} = \alpha_0 + \alpha_1 t_1 + \dots + \alpha_{k-1} t_{k-1} \quad \text{where } t_1 = t$$

$$t_c = (t - s_{c-1})_+^3 - \frac{(t - s_{k-1})_+^3 (s_k - s_{c-1})}{(s_k - s_{k-1})} + \frac{(t - s_k)_+^3 (s_{k-1} - s_{c-1})}{(s_k - s_{k-1})} \quad \text{for } c = 2, \dots, k - 1$$

⁸These sub-samples are then weighted using the official survey weights to make them representative of the general population. All descriptive statistics and estimation results in the paper use these sampling weights.

⁹We drop respondents who did not report time-use for more than 10% of the day as well as respondents for whom key variables were missing, such as household income.

¹⁰In the unweighted sample, this group is smaller than in the actual population, especially in the FTUS. Therefore, when analyzing age groups separately, we do not use this group.

¹¹In the ATUS, income is initially reported in intervals. We recode this measure into a continuous variable, namely the midpoint of each interval, and $1.5 \times$ the lower bound of the upper open interval. The distribution of the income measure for each country is shown in Appendix Figure A1

¹²The right panel in appendix Figure A1 shows the distribution of answers in both surveys. The FTUS distribution is more condensed, nearly 50% of respondents reported their health as 2 "very good", while the majority of ATUS respondent divide nearly equally across categories 2 and 3.

¹³Other surveys of the French population lead to the same observation. For example, in the annual survey of the French population run by Credoc (Centre de Recherche pour l'Etude et l'Observation des Conditions de Vie), 26 percent of individuals typically declare that they suffer from a handicap or a chronic or long run illness. However, only 6 percent of French people aged 15 to 64, have a certificate of invalidity that opens the right to a subsidy,

and the official proportion of workers whose activity is limited by a handicap or an illness is 18 percent (See <https://drees.solidarites-sante.gouv.fr/sources-outils-et-enquetes/02-les-enquetes-handicap-sante>).

¹⁴The ATUS question reads: "Please imagine a ladder with steps numbered from zero at the bottom to ten at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. If the top step is 10 and the bottom step is 0, on which step of the ladder do you feel you personally stand at the present time?"

¹⁵<https://www.bls.gov/tus/wbmintcodebk.pdf>

¹⁶Sleep is the largest category and is similar across groups, so it is omitted for presentation.

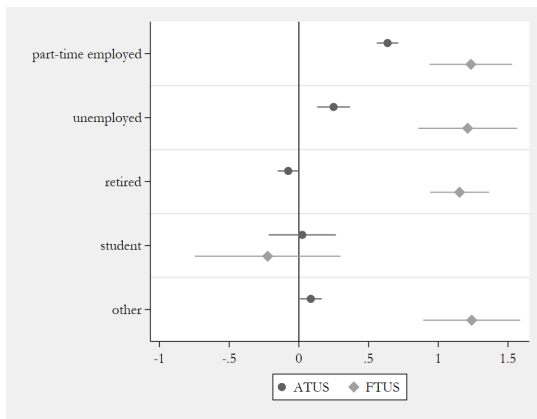
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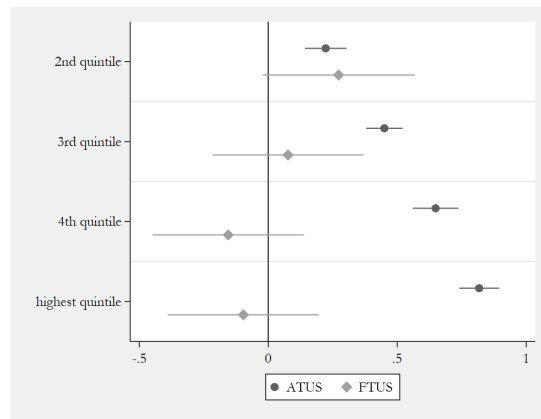
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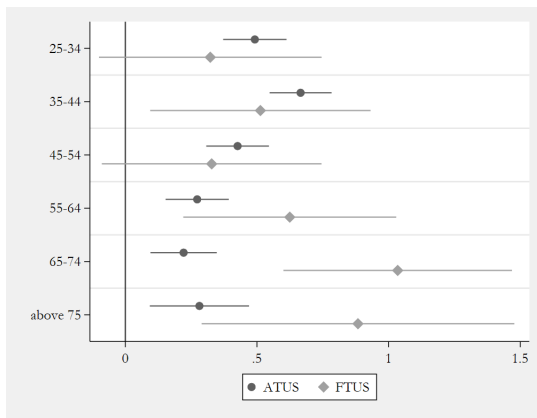
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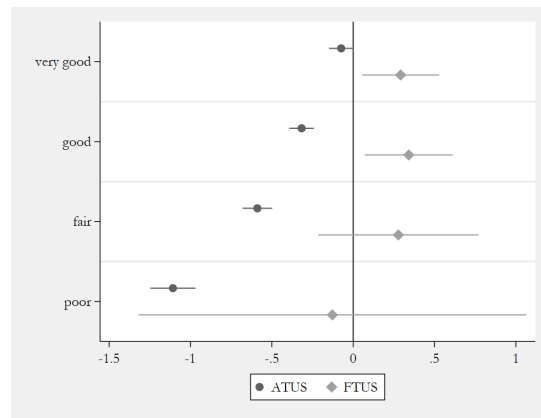
(a) Work status



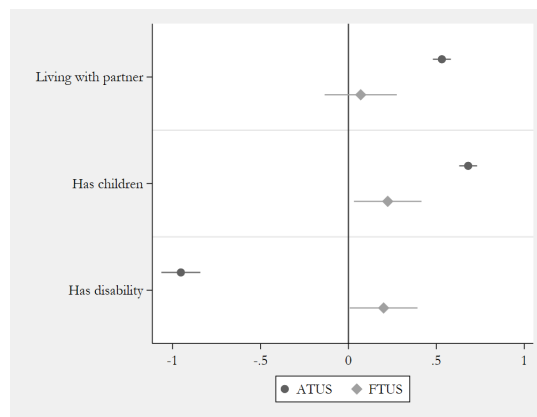
(b) Income quintile



(c) Age



(d) Health



(e) Cohabitation, children, disability

Figure 3: Heterogeneity in the S-W Index of Diversity

Notes: Each graph presents point estimates and 95% confidence interval, by country, of the difference in average time-use diversity between demographic categories, with respect to the base category: (a) employed; (b) lowest income quintile; (c) under age 25; (d) excellent health; (e) single; childless; without disability.

Data source: ATUS, 2012 and 2013; FTUS, 2010

Figure 4: Composition of Activities by Country and Gender

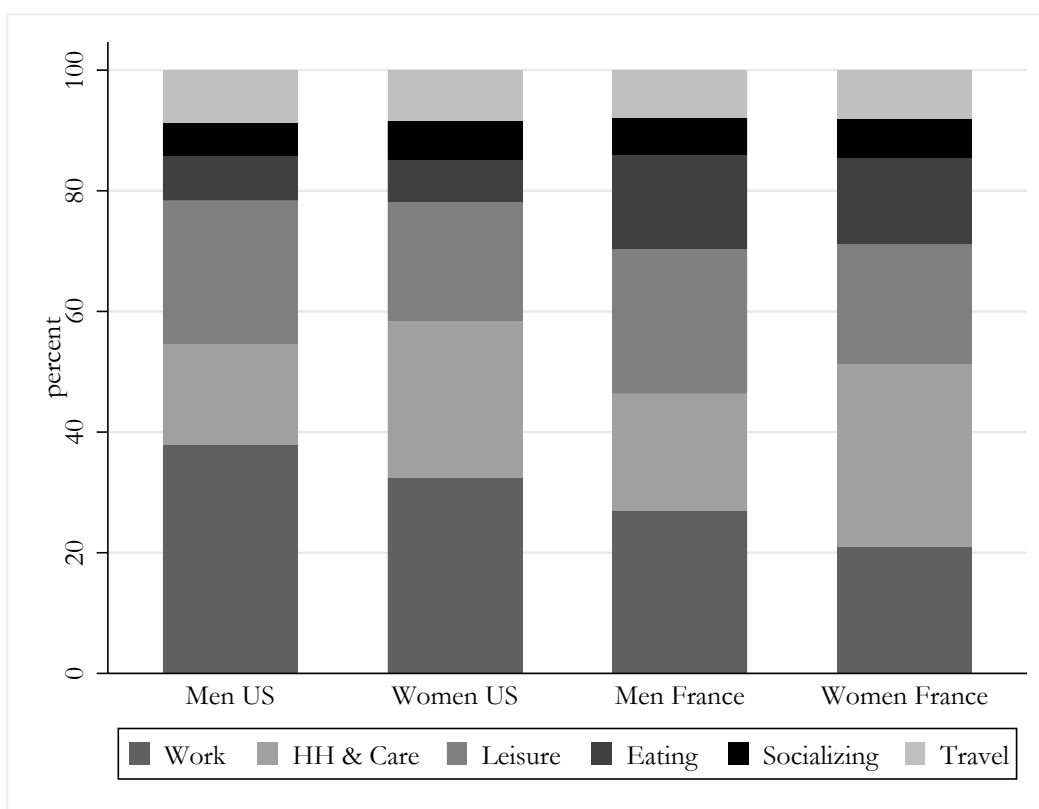


Figure 5: Composition of Activities by Country and Gender

Note: Shares of time use are calculated using population weights. For ease of presentation, sleep is omitted as it is the largest category and is similar across groups and several activity categories are combined as follows: Work includes all work and training related activities, including education; HH & Care includes personal care, care work and domestic work; Leisure includes relaxing & hobbies, recreation & sports and events & cultural activities. Shares are calculated over the entire time reported by each individual (single day in ATUS and two days in FTUS)

Data source: ATUS, 2012 and 2013; FTUS, 2010

Figure 6: Pleasantness and Time Spent on an Activity

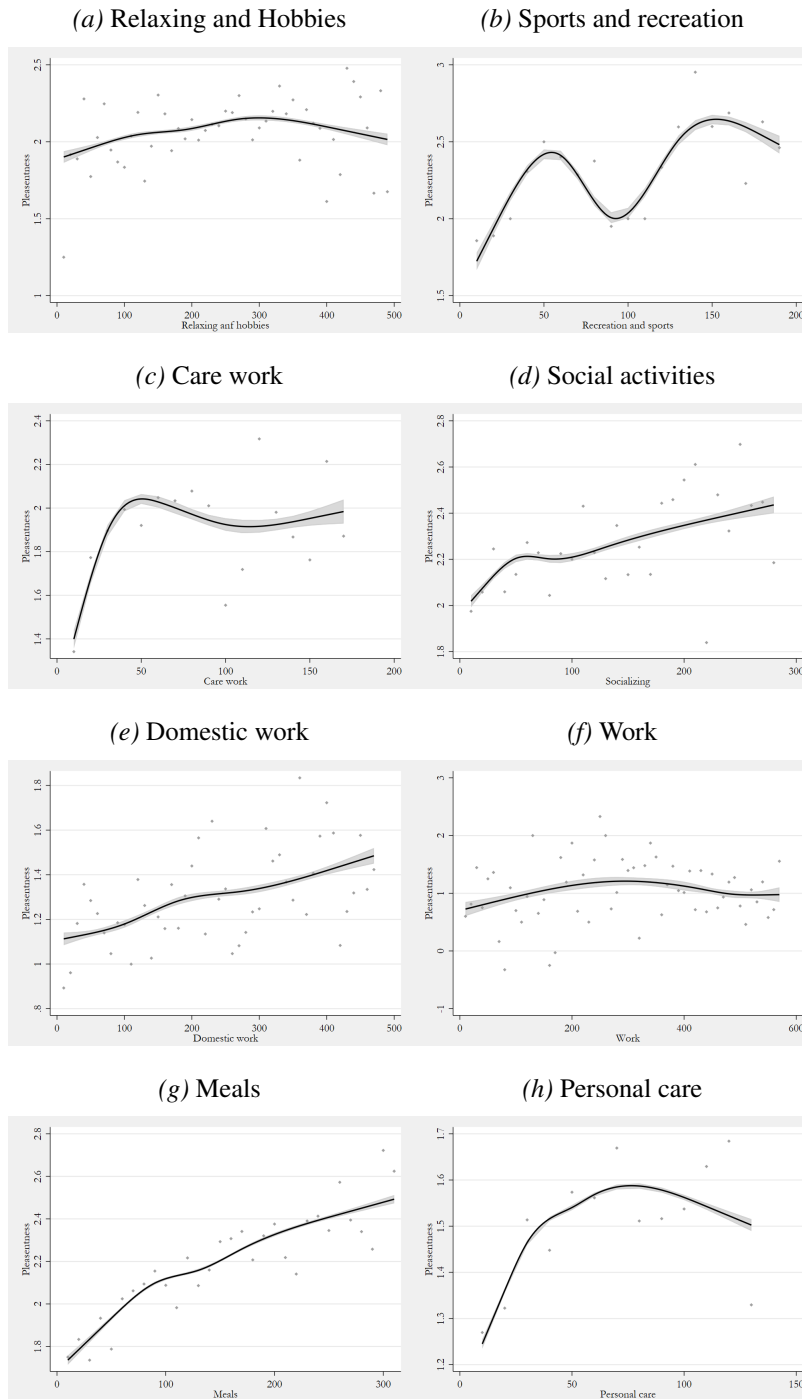


Figure 7: Pleasantness and Time Spent on an Activity

Notes: Each figure represents restricted cubic spline estimates of the relationship between the pleasantness score of an activity (which ranges from -3 to 3) on the y-axis and the time spent on an activity, in minutes. *Data source:* FTUS, 2010.

Table A1: Tier 1 and 2 Activity Category Definitions

Tier 1	Tier 2	FTUS- Tier 2 description	ATUS categories
Sleep	11	sleep	0101
Personal care	12	personal care	0102, 0104,0105,0805
Personal care	13	medical care	0103,0804
Personal care	15	other personal activities	0199
Eating and drinking	14	Meals	1101,1102,1199
Work	21	normal work	0501
Work	22	other work	0503,0599
Work	23	non-work at the workplace	0502
Work	24	job search	0504
Education and training	26	professional training	
Education and training	26	study and studying internships	0601,0602,0603,0604,0699
Education and training	26	non-vocational training and courses	
HH work	31	Meal preparation	0202
HH work	32	cleaning and laundry	
HH work	32	washing, ironing, clothes cleaning	0201,0901
HH work	34	housekeeping activities	0209
HH work	35	groceries and shopping	0701,0702,0703,0799
HH work	36	Use of administrative services	0801,0802,0803,0806,0807,0808,0899,1501
HH work	37	construction, repair and maintenance work	0203,0204,0207,0208,0902,0905,1503
HH work	38	gardening, artistic creations, pet care	0205,0206,0904,0903
HH work	39	other domestic activities	0299,0999
Care work	41	care of child of own and/or other household	0301,0303,0401,0403
Care work	42	Play and instruction activities for children	0302,0402
Care work	43	care of adults	0304,0305,0404,0405,0399,0499,1502
Socializing	51	social events and outings	1202,1505,1506,1599
Socializing	52	different forms of conversations	1201,1601,1699
Socializing	53	Religious practises, civil ceremonies	1401,1499
Socializing	54	Civic, and political activities and meetings	1001,1002,1003,1004,1099
Recreation and sports	61	Different sports	
Recreation and sports	61	Recreation Walks, fishing, camping, motorized rides	1301, 1303,1304,1399
Relaxing and hobbies	63	Reading, Watching TV, listening to music	
Relaxing and hobbies	63	doing nothing	
Relaxing and hobbies	63	Hobbies: playing	1203,1205,1299,1504
Relaxing and hobbies	63	computer activities	
Cultural activities	65	Visits & events	1204,1302
Commuting	81	Commuting for associative purposes	18XX

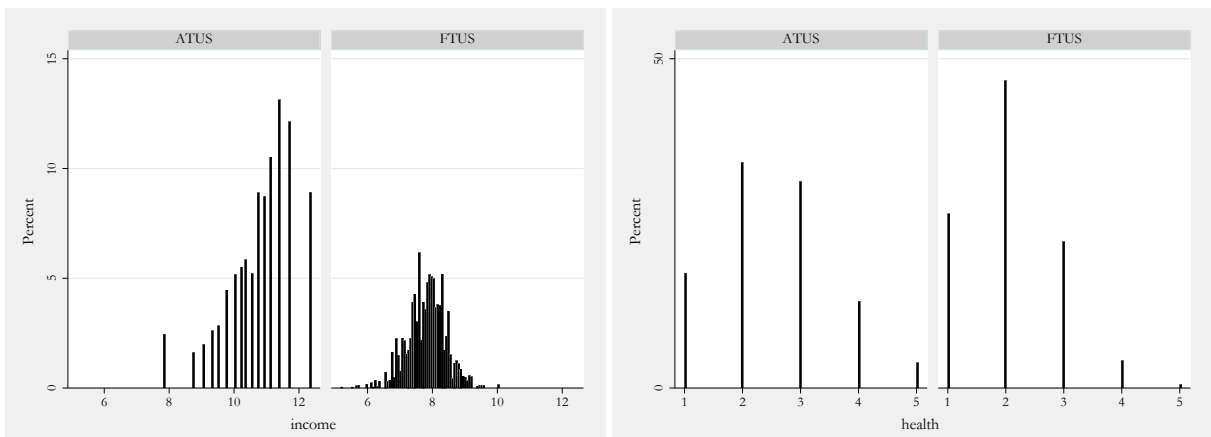


Figure A1: Distribution of Log Income and health for ATUS and FTUS Samples

Sample distribution using population weights.

Income: in the ATUS, household annual income is measured in categories; we assigned to each individual the mid-point income of each interval, and $1.5 \times$ the lower bound of the upper open interval. In FTUS, household income (per head) is measured as a continuous variable // Health: in both the FTUS and ATUS, health status is measured by respondents' answer to the question "Would you say your health in general is excellent (1), very good (2), good (3), fair (4), or poor (5)?"

Table A2: Estimated Average Marginal Effects of Variety (N Activities) on Life Satisfaction

	Life satisfaction above sample average				
	ATUS			Men	Women
	Main	Weekday	Weekend		
N activities	0.003 (0.000)	0.001 (0.000)	0.007 (0.000)	0.005 (0.000)	0.001 (0.000)
Observations	19198	9267	9931	8598	10600

	FTUS				
	Main	Weekday	Weekend	Men	Women
N activities	0.012 (0.000)	0.010 (0.000)	0.015 (0.000)	0.007 (0.000)	0.024 (0.000)
Observations	1218	1243	1246	569	647

Note: Dependent variable is whether and individual scored their life satisfaction at or above the score of 7 (the closest integer value to sample mean). Coefficients are average marginal effects for a standard deviation change in S-W index are derived from a probit regression weighted by population weights for each survey. Number of activities are counted for a single day in ATUS and over two days in FTUS. Average marginal effects are presented, standard error calculated using the delta method. All regressions include control for survey wave (12 in ATUS and 3 in FTUS) as well as year and weekend dummies (ATUS only), a continuous measure of household income, a second degree polynomial of sleeping time and indicators for: gender, cohabitation, presence of children, employment status, age categories (each category over 10 years), health status and and disability.

Data source: ATUS, 2012 and 2013; FTUS, 2010

Table A3: Continuous Fixed Effects Estimates of the Relationship between Momentary Utility and Activity Duration

	Personal care care	Meals	Domestic work	Care work work	Socializing	Relaxing and hobbies	Commuting	Work
Time in activity	0.221 (0.193)	0.235 (0.059)	0.036 (0.045)	0.264 (0.615)	0.095 (0.045)	-0.051 (0.045)	-0.242 (0.145)	0.088 (0.123)
Time in activity ²	-0.112 (0.079)	-0.024 (0.010)	-0.004 (0.005)	0.048 (0.173)	0.005 (0.005)	0.005 (0.005)	0.067 (0.042)	-0.002 (0.011)
Weekend	0.138 (0.033)	0.110 (0.022)	0.044 (0.035)	0.078 (0.067)	0.136 (0.058)	0.022 (0.029)	0.176 (0.041)	0.242 (0.117)
Observations	2082	2242	1826	404	616	1570	1568	284
Individuals	1041	1121	913	202	308	785	784	142

Note: Each column refers to an activity category. The dependent variable is an individual's average momentary utility score during that activity. Coefficients from a fixed-effects linear regression with individual fixed effects, weighted by population weights. All regressions include a weekend dummy. Sample includes respondents who engaged in an activity category in both reporting days and whose reported momentary utility varied between both days.

Data source: FTUS, 2010